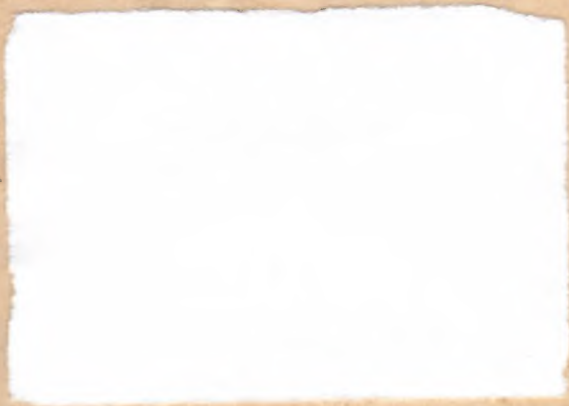




Canon BX-1

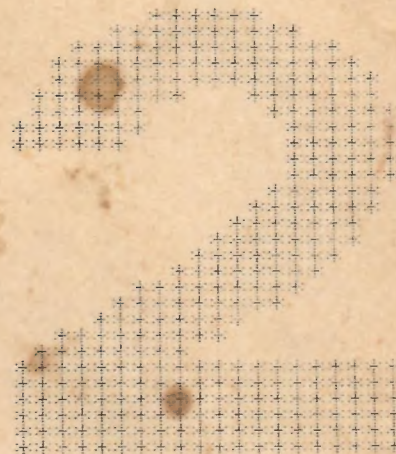
INSTRUCTIONS

Easy Programming, Part I

CANON BX-1 INSTRUCTION MANUAL

CHAPTER I

Manual Calculation



45678956321879541234
12374567895632187954
89541237456789563218
34568954123745678956
54123456895412374567
18795412345689541237
56321879541234568954
67895632187954123456
87456789563218795412
54123745678956321879
56895412374567895632
12345689541237456789
79541234568954123745
32187954123456895412
89563218795412345689
45678956321879541234
12374567895632187954
89541237456789563218
34568954123745678956
54123456895412374567

We are convinced that the BX-1 Desktop Computer, which Canon has manufactured with up-to-the-minute technologies, will be able to meet your every need in office use.

For the convenience of the user, the BX-1 Manual is composed of four volumes which contain the following contents:

1. Introduction to the BX-1

An outline of the BX-1 is presented, with an emphasis on photo presentations. Also presented are "how to's" such as the processes in roll paper replacement and the handling of connectors.

2. BX-1 Easy Programming, Part I

3. BX-1 Easy Programming, Part II

Presented here are instructions on how to program and how to use the BX-1, both with practical references.

Also presented are case studies with which you may learn for yourself.

4. BX-1 Operation Manual and Explanation of Instructions

Presented here are the operations of all the functions of the BX-1, designed to show every detail of use.

CANON INC.

PREFACE

The "BX-1 Easy Programming" is divided into two booklets, Part I and Part II. Part I is prepared for the user who is going to use the desktop computer for the first time and describes in sequence the knowledge up to the stage of producing simple programs.

Following Part I, Part II explains indirect designation, tabulation techniques, and examples of programming employing the mini-diskette.

After several program instructions are learned, problems using such instructions are given. Solve these problems in order to obtain deeper understanding of the instructions. Examples of answers to the problems are also included at the end of the booklet.

The "BX-1 Easy Programming" can be used for the following two-fold purposes:

1. As a textbook for understanding manual calculation and programming procedure.
2. As a guidebook for reviewing the usage of a particular program instruction.

When it is used as a textbook, read it successively starting from the first page. If it is used as a guidebook, refer to the "List of Program Instructions" attached to the end of this booklet and refer to the page where the particular instruction is described.

To indicate the degree of difficulty in understanding each Section, one of the following marks is affixed to the title of each Section for your reference:

- * Beginner's grade
- ** Intermediate grade
- *** Higher grade

CONTENTS

CHAPTER I MANUAL CALCULATION

[1] Manual Calculation	3
1. Preparation	3
2. Handling of Numbers	4
3. Functions	5
4. Variables for Manual Calculation	6
5. Examples	7
Exercise (1)	
[2] Printing of Characters	9

CHAPTER II PROGRAMING (I)

[3] What is A Programmed Calculation?	15
[4] Linear-type Program	16
1. Composition of One Line of Program	18
2. INPUT Statement	19
3. LET Statement	19
4. PRINT Statement (1)	20
5. END Statement	21
6. Rounding of Numerals	22
7. Sequence from Keying-in a Program through Execution	22
8. Operation Sequence for Example 4-2	25
Exercise (2)	
[5] Iterative-type Program (1)	27
1. REM Statement	28
2. FOR and NEXT Statements	28
Exercise (3)	
[6] Branching-type Program	32
1. IF and FLAG Statements	33
2. GOTO Statement	34
3. Flow Chart	34
Exercise (4)	
[7] Iterative-type Program (2)	37
1. NO-INPUT Statement	39

[8] Subroutine	40
1. GOSUB and RETURN Statements	41
Exercise (5)	

CHAPTER III EXECUTION OF PROGRAM (I)

[9] Variables	47
[10] Program Names	49
[11] Execution of Programmed Calculation	51
[12] Execution of Program Line by Line (TRACE)	53
[13] Program Listing	55
[14] Program Editing	56
[15] Errors	60
[16] Correction of SYNTAX Error	61
Appendix	
1. Handling of Mini-diskette	62
2. Answers to Exercises	63
3. List of Keywords	68
4. List of Functions	70
5. List of Commands	71
6. List of Statement Description Examples	72
7. Error Classification List	75
8. Keyboard	77

CHAPTER I MANUAL CALCULATION

In the following calculations, in which no program is used, the BX-1 can operate in a simplified manner by depressing keys according to the expression:

- Addition, subtraction, multiplication, and division
- Calculation including mathematical functions
- Calculation employing memory

In this Chapter, functions of the various keys necessary for manual calculation mentioned above are described. Since the key operation constitutes the basis of programs to be explained later in this booklet, the user is advised to become thoroughly familiarized with them.

[1] Manual Calculation

1. Preparation

(1) Turn ON power switch.

Turn ON power switch located on the right side of the BX-1. A "0" (zero) will appear on the display. If numbers other than the "0" are displayed, depress the **CLEAR** key and the **OPERATE** key, and only one "0" will appear on the display.

The **OPERATE** key puts the BX-1 in the OPERATE mode. This is the state in which manual calculations and programmed calculations are executed. When the power is turned ON, the beep sounds for a short period.

There is a function called the IPL (Initial Program Loading), in which a particular program may be transferred from the mini-diskette to the BX-1 for immediate execution, when the power is turned ON. With this function, numerals or characters other than "0" may sometimes be displayed.

(2) About the **AUTO PRINT** key lock.

When in the locked position, the **AUTO PRINT** key provides for the printing of the sequential steps and results of manual calculations. To use this function, depress and lock the **AUTO PRINT** key. To release the key after use simply depress the key a second time.

(3) Rounding of numbers

When the power is turned ON for the first time, the BX-1 is in FLOAT state and figures other than particularly large or small numbers are displayed with the fixed mantissa floating decimal point system. (For further details of rounding the number, refer to page 22.)

(4) Roll paper

Thermal paper of varying widths may be used.

Available paper size: 77mm (24 digits), 140mm (48 digits), 216mm (80 digits)

2. Handling of Numbers

Entering a number into the BX-1 for calculating purposes is called "numeric input."

For instance, when a number such as:

123.45

is to be entered, depress the numeric keys on the 10-keyboard following the sequence of the written numerals as follows:

1 2 3 . 4 5

When numeric keys are depressed, a numeral appears in the rightmost position of the display section with each depression. The numeral which appeared previously shifts leftward one by one, until finally numerals are arranged on the BX-1 display as written.

Inside the BX-1, the above-mentioned number is expressed as

1.2345×10^2

This method of expressing a number as above is called the scientific notation system. In the display, the "x 10" is omitted, as follows:

1.2345E + 02

In this example, "1.2345" is called the mantissa section, and "02" the exponent section.

A number may be entered by such a scientific notation system.

In the above-shown example, depress the keys in the following way:

1 . 2 3 4 5 EXP 2

When entering a negative number, first enter the number as a positive number and then depress the **SIGN CHG** key. When a negative number is entered, a minus (—) sign is displayed just in front of the number. The same applies to the exponent section.

When the **SIGN CHG** key is depressed, a positive number is changed into a negative number and vice versa. For the following two numbers, depress keys in the order shown to the right of the numbers.

—123

1 2 3 SIGN CHG

—123 x 10⁻¹²

1 2 3 SIGN CHG EXP 1 2 SIGN CHG

When you make a mistake in entering a numeral depress the yellow **CE** (Clear Entry) key immediately, and the display will change to "0". Then enter the correct number again.

If the **CE** key is depressed in the middle of calculation, the effects of previous key depressions remain intact. Enter the corrected number again, and the calculation can be resumed.

For example, if keys are operated as **1 2 x 3 . 4 CE 2 0 =**, the following calculation is completed:

12 x 20 =

3. Functions

With the BX-1, the mathematical functions shown in the table below can be calculated simply by depressing the respective keys.

Key operation for calculating functions is the same as that for forming the program.

A calculation formula as well as a number can be applied to symbol "X" described in the following "key operation" (Ex. 3).

In manual calculations, parentheses before and after "X" can be omitted (Ex. 1).

Function	Commentary	Key operation
$\sqrt{X}$	Square root	$\sqrt{\text{ (X) }} =$ (note 1)
a^x	Power	$a \text{ (} a^x \text{) } =$
SGN (X)	+1, if X is positive; -1, if X is negative; 0, if X = 0.	INST 0 (X) =
ABS (X)	Absolute value	INST 4 (X) =
FRC (X)	Taking-out fractions	INST 5 (X) =
RND (X)	Uniformly random numbers of 0 to 1	INST 6 (X) = (note 2)
LGT (X)	Common logarithm	INST 7 (X) =
LOG (X)	Natural logarithm	INST 8 (X) =
EXP (X)	e^x	INST 9 (X) =

NOTE: 1. For this key, and one of $+$ $-$ $\times$ or $\div$ may be used. The same is applicable to all calculations of functions.

2. Any desired number will do.

3. Users who want to use trigonometric functions and inverse trigonometric functions are advised to obtain the trigonometric function pack.

Ex. 1 Determine $\sqrt{144}$.

Key operation: $\sqrt{\text{ (1 4 4) }} =$

Answer: 12

Ex. 2 Determine 15^3 .

Key operation: $1 \text{ (} 5 \text{) } a^x \text{ (3) } =$

Answer: 3375

EX. 3 Determine LGT (2 + 3). ($\log_{10} (2 + 3)$)

Key operation: INST 7 (2 + 3) =

Answer: 0.6989700043

○When the a^x key is used for calculation, "a" should be a positive number.

4. Variables for Manual Calculation

In manual calculation, it is sometimes convenient to give a value to the variable in advance and to use the variable in performing the calculation.

For instance, to obtain the value of $A^2 + 2A + 1$ when $A = 2$, operate keys as follows:

2 STORE A
A × A + 2 × A + 1 =

In this way, 26 capital letters of the English alphabet A to Z, are provided as variables for manual calculation. To give a value, 123, to variable A, depress keys as follows:

123 STORE A

To recall the value of variable A, simply depress the following key:

A

At this time, the PROG SELECT key must not be in the depressed state (not in the locked state).

If the key is locked, the depression of the A key will bring a program called "A" from the mini-diskette to the BX-1 and execute it.

- Variables A to Z are called the fixed variables, and the values which are manually given to these variables can be also used in programmed calculation and vice versa.
- The contents of these fixed variables A to Z can be cleared (to 0) by depressing the CL A-Z key.

5. Examples

On the right side of the expression, the sequence of key operation is shown.

The $\square$ for the numeral key is omitted.

$$\circ 2 + 3 \times 5 = 17$$

$$2 \square + 3 \square \times 5 \square =$$

$$\circ 4 \times (-3) = -12$$

$$4 \square \times 3 \square \text{SIGN CHG} \square =$$

$$4 * -3 = -12$$

The SIGN CHG key changes the sign of the display.

$$\circ 17 \times 2 + 10 = 44$$

$$17 \square \times 2 \square + 10 \square =$$

$$17 * 2 + 10 = 44$$

$$\circ (17 + 2) \times 10 = 190$$

$$\square (17 \square + 2 \square) \square \times 10 \square =$$

$$(17 + 2) * 10 = 190$$

$$\circ 1 + 2 \times \{-3 + 4 \times (5 + 6)\} = 83$$

$$1 \square + 2 \square \times \square (3 \square \text{SIGN CHG} \square + 4 \square \times \square (5 \square + 6 \square) \square) \square =$$

$$1 + 2 * (-3 + 4 * (5 + 6)) = 83$$

$$\circ \frac{0.36}{1+2+3} = 0.06$$

$$.36 \square \div \square (1 \square + 2 \square + 3 \square) \square =$$

$$0.36 \div (1 + 2 + 3) = 0.06$$

The zero of 0.36 can be omitted.

$$\circ \sqrt{625} = 25$$

$$\square \sqrt{\square} 625 \square =$$

$$\text{SQR } 625 = 25$$

$$\circ 5^3 = 125$$

$$5 \square \alpha^x \square 3 \square =$$

$$5 ** 3 = 125$$

$$\circ 5^{-3} = 0.008$$

$$5 \square \alpha^x \square 3 \square \text{SIGN CHG} \square =$$

$$5 ** -3 = 0.008$$

$$\circ \sqrt[3]{512} = 512^{\frac{1}{3}} = 8$$

$$512 \square \alpha^x \square (1 \square \div 3 \square) \square =$$

$$512 ** (1 \div 3) = 8$$

$$\circ \sqrt{3^2 + 4^2} = 5$$

$$\square \sqrt{\square} (3 \square \times 3 \square + 4 \square \times 4 \square) \square =$$

$$\text{SQR } (3 * 3 + 4 * 4) = 5$$

$$\circ e^{1.4} = 4.055199967$$

$$\text{INST} \square \text{9} \square 1.4 \square =$$

$$\text{EXP } 1.4 = 4.055199967$$

$$\circ \text{Common logarithm } \text{LGT } 5 = 0.6989700043$$

$$\text{INST} \square \text{7} \square 5 \square =$$

$$\text{LGT } 5 = 0.6989700043$$

$$\circ \text{Natural logarithm } \text{LOG } (3 \times 2) = 1.791759469$$

$$\text{INST} \square \text{8} \square (3 \square \times 2 \square) \square =$$

$$\text{LOG } (3 * 2) = 1.791759469$$

$$\circ \text{Determine } x \text{ when } \text{LGT } x = 0.602.$$

$$x = 10^{0.602} = 3.999447498$$

$$\text{1} \square \text{0} \square \alpha^x \square .602 \square =$$

$$10 ** 0.602 = 3.999447498$$

$$\circ \text{Determine } x \text{ when } \text{LOG } x = -1.2.$$

$$x = e^{-1.2} = 0.3011942119$$

$$\text{INST} \square \text{9} \square 1.2 \square \text{SIGN CHG} \square =$$

$$\text{EXP } -1.2 = 0.3011942119$$

When the calculation is temporarily suspended in the middle and you want to move to a separate calculation, depress the CLEAR key and start the new calculation.

Exercise (1)

$$1. 456 + 789 = 1245$$

$$2. 96 + 54.3 = 150.3$$

$$3. 56.78 - 88 = -31.22$$

$$4. 90 - 11.1 = 78.9$$

$$5. -2.7 \times 7.89 = -21.303$$

$$6. 5 \div (-6) = -0.833333333333$$

$$7. (78 + 192) \times (384 - 51) = 89910$$

$$8. (560 - 24) \div (3 \times 6 + 20) = 14.10526315789$$

$$9. 0.1 \div 2 \times \{1 + 2 \times (3 + 4 \times 10^{-3}) + 0.5\} = 0.3754$$

$$-9 \times 10^{-3} \rightarrow \boxed{9} \text{ SIGN CHG } \boxed{\text{EXP}} \boxed{3} \text{ SIGN CHG}$$

$$10. 3 \times \{2 - 5 \times (0.3 + 2 \times 10^{-3}) - 0.5\} = -0.03$$

$$11. \frac{2 \times 3}{5^2} = 0.24$$

$$12. \frac{5 \times 7}{2 \times 3} = 5.833333333333$$

$$13. \sqrt{20^2 + 21^2} = 29$$

$$14. \sqrt{13^2 + 14^2} = 19.10497317454$$

$$15. 7^3 = 343$$

$$16. 11^3 = 1331$$

$$17. \sqrt[3]{729} = 9$$

$$18. \sqrt[3]{0.008} = 0.2$$

$$19. e^{1.4} = 4.055199967$$

$$20. e^{-2.5} = 0.08208499862$$

$$21. \text{LGT } 3 = 0.4771212547$$

$$22. \text{LGT } 0.5 = -0.3010299957$$

$$23. \text{LOG } 5 = 1.609437912$$

$$24. \text{LOG } 1 = 0$$

$$25. \text{When } X = 2, \text{ determine the value of } Y \text{ from the following equation:}$$

$$Y = 3X^3 + 2X^2 - X \quad (Y = 30)$$

$$26. \text{When } X = 2, \text{ determine the value of } Y \text{ from the following equation:}$$

$$Y = \frac{1}{3X^3 + 1} \quad (Y = 0.04)$$

*[2] Printing of Characters

The BX-1 can print and display the alphabet (capital and small letters), numerals, and symbols.

These letters, numerals, and symbols are generally called the characters.

To print characters such as "AB," depress keys as follows:

PRINT * A B * CR/LF

Characters are as follows:

When the **CAP** key is depressed (CAPITAL LETTER mode):

Alphabet (capital letters), numerals and symbols.

When the **SML** key is depressed (SMALL LETTER Mode):

Alphabet (small letters) and symbols.

When the **UC** key is depressed (UPPER CASE mode):

Alphabet (capital letters), numerals and symbols.

When the **CTRL** key is depressed (CONTROL CODE mode):

Special characters such as the movement of the printer head.

To find out which characters will appear when the above-mentioned four keys are depressed, refer to the keyboard table on the next page.

The above-mentioned four modes are called CHARACTER modes. The CAPITAL LETTER mode, SMALL LETTER mode and UPPER CASE mode maintain their respective states until another CHARACTER mode is specified. The CONTROL CODE mode, however, is valid only for the one character which is depressed immediately after the **CTRL** key. The user is cautioned against this difference between the CONTROL CODE mode and other three CHARACTER modes.

Ex. 1 Print "CAMERA camera 100%."

PRINT * CAP C A M E R A SPACE

The same key

SML C A M E R A SPACE CAP 1 0 0 % * CR/LF

It is printed immediately upon depressing the **CR/LF** key.

CAMERA camera 100%

Ex. 2 Print "The dog; north pole."

PRINT * T SML H E SPACE D O G CAP ; SPACE

N SML O R T H SPACE P O L E CAP * CR/LF

Do not forget this.

The dog; North pole

1. When the **CAP** Key Is Depressed:

/	#	\$	%	&	'	{	¥	}	@	<	>						
Q	W	E	R	T	Y	U	I	O	P	—	CR/LF						
A	S	D	F	G	H	J	K	L	:	:							
Z	X	C	V	B	N	M	,	?	^								
CAP																	
SPACE																	
7			8			9			()								
4			5			6			* /								
1			2			3			+ -								
0						.			=								

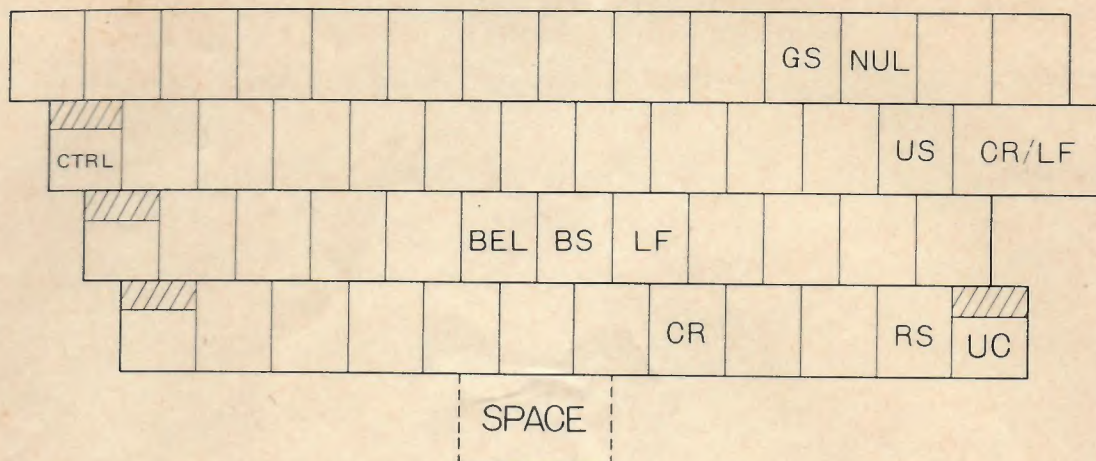
2. When the **SML** Key Is Depressed:

↑	↓	→	←	≠	≤	≥	{		}	,	□	£					
q	w	e	r	t	y	u	i	o	p	⌘	CR/LF						
a	s	d	f	g	h	j	k	l	⌘	⌘							
z	x	c	v	b	n	m	π	⌘	—								
SPACE																	
⌈			⌋			⌌			× ÷								
◇			-						√ ⌘								
□			×			+			x ∑								
.			L						'								

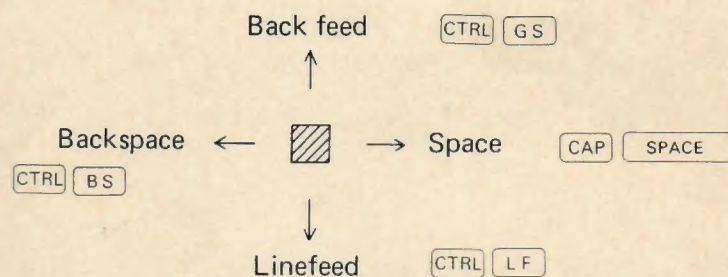
3. When the **UC** Key Is Depressed:

1	2	3	4	5	6	7	8	9	0	@	<	>					
Q	W	E	R	T	Y	U	I	O	P	—	CR/LF						
A	S	D	F	G	H	J	K	L	:	:							
Z	X	C	V	B	N	M	,	?	^	UC							
SPACE																	
7			8			9			()								
4			5			6			* /								
1			2			3			+ -								
0						.			=								

4. When the **CTRL** Key Is Depressed: (Only control characters effective on the BX-1 are mentioned here.)



Movement of Printer Head:



- LF (Linefeed) : (**J** key) Feeds one new line with the printer head at the same position.
- GS (Back feed) : (**J** key) Goes back one line.
- BS (Backspace) : (**H** key) Shifts back one character.
- CR (Carriage return) : (**M** key) Moves the printer head to the leftmost end.
- RS (Half pitch) : (**^** key) Designates the movement of the printer head to half pitch.
- US (Normal pitch) : (**—** key: neighboring key to **CR/LF**) Designates the movement of the printer head to normal pitch.
- BEL (Bell) : (**G** key) Sounds the buzzer.
- NUL (Null) : (**@** key) Blank

CONTROL CODE mode will not be maintained. Therefore, when, for example, the **GS** key is depressed and the **BS** key is to be depressed immediately thereafter, it is necessary to depress the **CTRL** key again before depressing the **BS** key. When the CONTROL CODE mode ends, the machine will return to the pre-depression state (for instance, the state in which the **CAP** key is depressed).